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1. 発明の名称 電解コンデンサの製造方法

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~~4. 特許請求の範囲に記載された発明の数 3~~

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(1) 明細書 1通
(2) 図面 1通
(3) 願書副本 1通

方式審査

明 細 書

1. 発明の名称

電解コンデンサの製造方法

2. 特許請求の範囲

(1) 高純度アルミニウム箔をエッチングし、次いで化成処理により誘電体を生成せしめてなるアルミニウム電解コンデンサに於いて、平滑な原箔の連続エッチング時に、流れ方向に所定巾(5%以上)の未エッチング帯を形成せしめる。而して、諸処理の後、捲上げ素子用に切り出された箔は、陽、陰極箔を問わず片側に該未エッチング帯を備えることを特徴とする電解コンデンサの製造方法。

(2) 電解コンデンサ用、両極箔に紙を介在させて捲上げるに当り、上記未エッチド帯を左右、両端辺部に位置付けし、且つ、該帯域は、互に他の電極箔のエッチド帯域とは、幾何学的に、対向せぬよう、相互にズラして捲上げ、或は折りたたみ重ねることにより、素子本体を構成させしめるを特徴とする電解コンデンサの製造方法。

~~(3) 上記の如き基本的構造をもち、偏平化されたコンデンサ素子の、その左右に位置する未エッチド帯層をして、その約$\frac{1}{2}$を残して、他を切りとり、その残された未エッチド帯部は、両極用一対の、アルミニウム製電極引出し用板—例えば、湾曲円弧状アルミニウム板—に予め設けせしめた、直立時、縦方向に走る狭巾スリット状溝(縁付き)の中に挿入する。かくの如く、一対の電極引出し板に、互に対をなす、複数個の溝を設け、偏平素子の両端辺部に当る未エッチング帯層を複数個挿入し、該帯層と溝縁との間で熔着せしめて本体を構成せしめることを特徴とする大容量向電解コンデンサの製造方法。~~

3. 発明の詳細な説明

本発明は、電解コンデンサ製造方法に係り、高純度アルミニウム箔の表面粗面化工程に於いて、未エッチド部分を帯状に残置せしめ、両極箔の捲上後の工程にて、それらの部分を活用し、無誘導

(1)

(2)

化のためのアルミニウム溶箔の第一条件を付与させ、更に電極接合の合理化と小型化を計る機構を開発し、製品の電気特性、信頼性向上に寄与せしめるものである。

従来、大容量電解コンデンサの製作に当つては、その陽、陰極用箔が、捲上げ方向に長いため、ややもすると金属箔自体の箔抵抗分とかインダクタンス分が、コンデンサ特性を損い、損失値の増大、高周波特性等の弱体を露呈し、それらの改善が強く要望されるに至つた。即ち昨今、より高い周波数（10KC～100KC）用の大容量コンデンサの活用は、例えば、電算機電源用としても、電源の小型化、消費電力の節減とも係り不可避の段階を迎え、近年に至り盛んに改善工夫がなされており、それらに関連し、引出しリード位置の考究改善、引出しリードの本数の増加、介在紙質の改善、含浸電解質の改良等々がなされてきた。一方、構造的に比較的原理に忠実な、特許願　昭46－81740に代表される構造、即ち従来の捲込み円筒形構造とは、一見、傾きを異にし、偏平型素子ブロック

トレスの過重を与え、素子特性を劣化に導き易く、更に又、エッチド箔の性質上、接合部の連続均一性が保持し難く、又、電極箔の使用効率及び内容積の活用効率等問題点として挙げられる。

これらに対し、ここに記述する本発明は、陽、陰極用アルミニウム箔自体に、予め無誘導化のための熔接を考慮した未エッチド帯を付与せしめておくこと、又一方、電極引出し用アルミニウム板の構造、配置を独特のものとし、熔接時の熱的影響を極力軽減し、又熔接部の不純物管理が原理的にも最も安全に行い得るような構造に工夫され、且つ熔接箇処の信頼性、均一性を一段と向上せしめ、他方、容積活用効率の増大化を期した、品質特性の優れた大容量向き電解コンデンサの製造方法を提供するものである。

以下本発明の内容を代表例を挙げて述べる。

第一に、陽、陰極用高純度アルミニウム箔の連続電解エッチングに当り、腐蝕液は、塩酸を主とした従来的な水溶液が使われて差支えなく、又電解方式としても特記するものはないが、しかし、

を背負わせた構造と、新しい電極接合方式との組合わせの内容をもつ電解コンデンサの出現を見るに至つた。

併しながら、前者に於いては、陽、陰極箔よりの引出しリード位置がそろい難く束ね難い等、陰、陽リードの乱立にあつて、従来方法では制約が多く、不具合さが目立ち、加えて、該方式では、特性限界への挑戦に当り、最終的に問題の残ることが予測されるものである。これに対し、後者の如き偏平型コンデンサのブロック背負わせ方式に於いては、すでに構造原理的に、内部容積の活用効率に弱点をもち、他方エッチド箔の積層部と電極引出し用アルミニウム板とを熔接するためには、最高度の熔接技術、管理技術が不可欠な上に、製作~~過程に於ける~~工程中の不純物管理等に最高レベルのものが要求される等、製作過程に於いても、一般的にみて難点を内蔵している。

換言すれば、製作方法的に、通常の作業環境下では、無理の生じ易い弱点を伴うものであり、しばしば熔接部の保証のために、素子本体に熱的ス

本発明の特徴の一つは、あくまでこのエッチング工程にある。

即ち、従来と異なり、エッチングに当り、原箔と液中のカーボン電極との相互位置の関係及び箔とカーボン電極間隔に工夫を施すとか、アルミニウム原箔の縦方向に作為的に電気的絶縁帯を設けしめることにより、エッチング工程通過後の処理箔に、一部所定巾の未エッチド帯部第1図1、~~1'~~（巾5㍉以上）を残留せしめるものである。

即ち、例えば連続エッチング工程に於ける液中の二つの並列電極カーボン板と、その中央面を移動するアルミニウム箔との相互間隔を約2㎝前後とし、カーボン板の外側の裏面と側面を硬質フイルム板で密着して覆い電気的に遮断をなし、一方アルミニウム箔は、予め、両カーボン電極の中に浸漬させながら、端辺部は該両電極板より1㎝以上ハミ出させ、殆んど電解エッチング効果の影響の及ばぬ如く配置せしめた後、連続エッチングを行う。一かくの如き方法は、極めて簡易な未エッチング帯の作成方法の一例に過ぎぬが、中央部のエ

ッチング箔の活用を別途になし得ることとからして十分実用方法としても成立するものである。

かくの如くして得られる高純度アルミ箔の両端辺部は、第1図の如く所期巾の、実用上未エッチド帯部第1図1又は1－(イ)と見做し得る帯域を構成し、エッチドされた帯域第1図2又は2－(ロ)と隣接したものとして得られる。

その他の方法の一つには、アルミ原箔の移動に伴い連続的に所定巾の絶縁性フイルム を所定位置のところに原箔に両面より添わせる如く粗ぼ密着せしめつつ移動させて、連続エッチングを行うことにより、複数条の未エッチド帯部第1図1(及びその他)又は1－(イ)を構成せしめ得る。その他、感光樹脂塗布等による方法等々が考えられる。

次に第2として、該エッチド箔は陽或は陰極用にそれぞれの目的箔用に処理された後、互に含浸剤保持用の隔離紙第2図3を隔て、両極箔が捲込まれるに当り、両極箔の片側端辺に存する未エッチド帯部第2図1－(イ)と1－(ロ)は互に左右にズラして捲上げられる。その折、エッチドされた帯域第2図

(7)

る。その略図を第3図(A)(B)に示す。その残置帯部の位置は特に中央部である必要はなく、これらは、後述の引出し用電極アルミニウム板のスリット状溝位置に、はめこむを便にするよう予め設定されるものである。

即ち、その偏平形コンデンサの未エッチド帯の残置突出部の一対は例えば第4図に示す如き、端子部と直結する湾曲した円弧状アルミ板第4図(A)(電極引出し用)一対向し、独立する一対の板に設けられた、巾約2～3㎜前後のスリット状縁付き溝4(未エッチド帯挿入用)の中に、スライドする如く挿入される。(その他)湾曲した平板状のアルミ板(第4図(B))等も同様である。7は端子にそのまま連結する板リード部分を示す。概況は第5図に示す如く、該スリット状縁付き溝4は、通例複数条設定され、偏平形コンデンサの複数条個の挿入により、内部空間は、極小になるよう予め設計され、設定されるを立前とするものである。

かくて、例えば、上記対向する円弧状電極引出し用アルミニウム板6一対の囲む空間は、複数個

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と2－(ロ)は互に介在紙を隔てて対向し、未エッチド帯とは対向せしめないことを原則とし、介在紙は又、エッチド帯域に対してのみ必要十分に覆うものとするが、未エッチド帯部に対しては、なるべく対向部分を少なくするよう顧慮がなされるものとする。これを断面的にとらえると、捲上方向に於ける箔の重なり具合は(例えば)第2図(A)(B)の如くなる。ここに、本方式にかかわる具体的な、コンデンサ製造方法の一、二の例を述べる。

同じ電極箔の未エッチド帯部第2図1又は1－(イ)は、捲上後、直接に自体の延長帯と互に真向う如く位置付けされる(即ち)か、或は1－(ロ)はるが、ここでは、この素子の捲上げは、予め板状の骨板をベースに折りたたみ式に偏平に捲き上げるか、或は、中を中空にして円筒形に捲き上げた後、軽くプレスして偏平形とされる素子のブロック化により構成されるものについて述べる。

かくて得られる偏平形コンデンサ用素子は両端辺に未エッチング帯部第3図(A)、1又は1－(イ)、1－(ロ)が存在するが、その帯部については、例えば約半分を残し他は切り取るものとする。なお、該残置帯部第3図(B)は、その切断の前後に、その帯部のみ強圧し、端辺はスキを極小にする処置がとられ

(8)

の偏平形コンデンサ8が、未エッチド帯部の溝への挿入と共に、素子により充たされ溝杯となる。この場合、偏平形素子サイズは、2～3種とすることが望ましい。次に縁付き溝と挿入された未エッチド帯突出部とは、更に両縁より強圧して合わされ、更にレベル合わせのため端辺に沿つて鋭く切断される。かくてその端辺はアルミニウム熔着のために非常に有効な断面構造を具備するばかりでなく、一方では、熔接時の過熱が、内部の素子本体に及ぼす影響を小さくし、不純物管理面からみても良好な条件を具えたものとなる。かくて、MIG熔接方式等により、第6図の如く容易にアルミニウム熔接が安全になされる。

このようにして得られた素子は、ペースト含浸前後に、陽極部電極引出し板等を絶縁フイルム等で一部覆う等の処置も考慮する中で、その後主として従来的手順を経て電解コンデンサとして製品化されるが、ともあれ、本発明の製品は、上記構造の下で電極箔のもつ抵抗分及びインダクタンス分を極めて小なるものとし、且つアルミ熔着面を明らか

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に高信頼性化する上、更には、作業面の簡潔化による不純物の介入を軽減せしめるため、一般電気特性、周波特性高リプル特性共に、優位性の保証されることは明らかなものである。

即ち本発明は、特に高周波数放特性、高リプル特性と共に、信頼性の向上の期される大容量コンデンサ向の電解コンデンサの製造方法である。

4. 図面の簡単な説明

第1図は、本発明の未エッチド帯を具えたアルミニウム箔の表面区分の代表例を示す。

第2図(A)は、本発明による素子捲上時の、電極箔と介在紙との相互位置関係を示す断面からみた代表例を示す。第2図(B)は本発明によるコンデンサ素子の最も単純な構造例。

第3図の(A)は偏平化された本発明によるコンデンサ素子の外観略図例で、鎖線により両極箔夫々の未エッチド、及びエッチド帯域の境目を透視的に示す。(B)は未エッチド帯部の一部を切りとり、その部を強圧した後の本発明の概略図である。

第4図(A×B)は、本発明による電極引出し用アルミニウム板の2つの例を示す。

第5図は、本発明によるコンデンサの具体的一例としての素子本体の外観図である。

第6図は、本発明による側に伸る電極引出し用板に設け切れた スリット状溝に未エッチド帯残留部を挿入し、端辺処理後、アルミ熔接した所の外観略図を示す。

1は未エッチド帯部、2はエッチドされた帯域、1-(イ)は陰極箔の未エッチド帯部、2-(イ)は陰極箔のエッチドされた帯域、1-(ロ)は陽極箔の未エッチド帯部、2-(ロ)は陽極箔のエッチドされた帯域、3は含浸剤保持用の隔離紙、4はスリット状縁付き溝、5は縁付き部分の端辺、6は円弧状電極引出し用アルミニウム板、7は端子にそのまま連結する板リード板部分、8は偏平形コンデンサ。9は、未エッチド帯の残置突出部。

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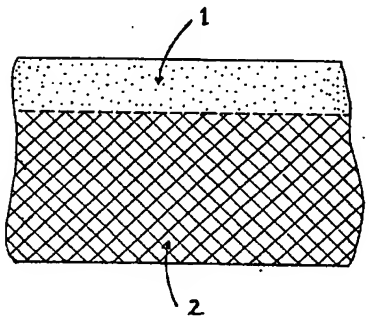
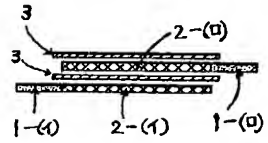
代表者　小　山　佐　近

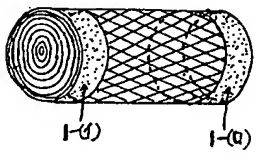
第1図



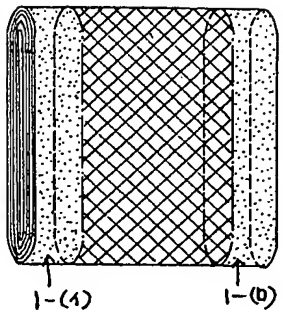
第2図(A)



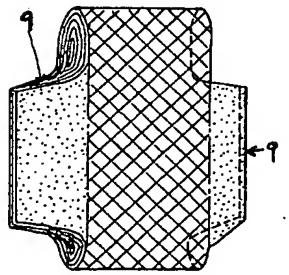
第2図(B)



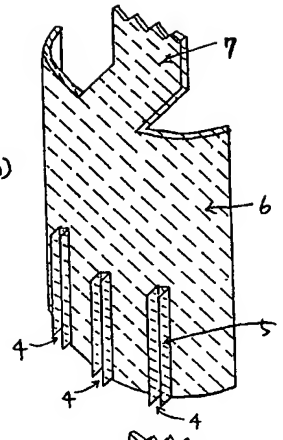
第3図(A)



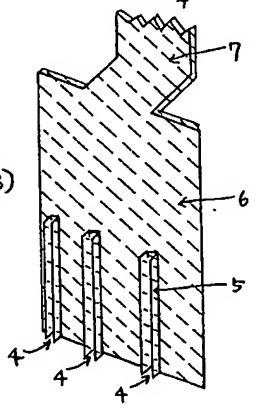
第3図(B)



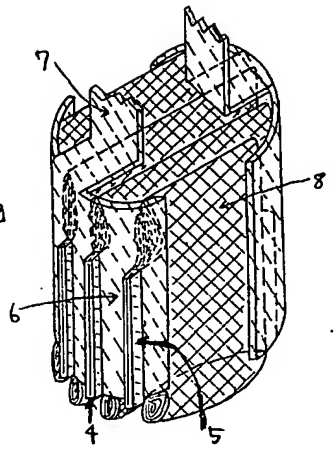
第4図(A)



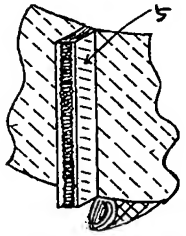
第4図(B)



第5図



第6図



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Patent Application

June 27, 1975

To the Director of the Patent Office: [stamp: OK]

1. Title of the invention: Manufacturing method for electrolytic capacitor

2. Inventor: Jin Nakamura (and 2 others) [stamp: Patent Office, June 30, 1975, 2nd Applications Section, Kamisaka]
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~~4. No. of claims in scope of patent claims: 3~~

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~~5.~~ List of attachments:

4. (1) Specification: 1 copy
(2) Drawings: 1 copy
(3) Duplicate application: 1 copy

Formal examination
[seal: Akiba]

Specification

1. Title of the invention: Manufacturing method for electrolytic capacitor

2. Scope of patent claims:

(1) An aluminum electrolytic capacitor for etching high-purity aluminum foil, and generating dielectrics by formation treatment, wherein a non-etched band of specified width (5 m/m or more) is formed in the machine direction when conducting continuous etching of a ~~regular~~ *smooth* original foil; and a manufacturing method for electrolytic capacitor where, after various treatments, the foil that has been cut out for use in the winding element is provided with said non-etched band on one side regardless of whether it is anode or cathode foil.

(2) A manufacturing method for electrolytic capacitor wherein, with regard to the winding that is conducted upon interposition of paper amid the bipolar foil for use in an electrolytic capacitor, the said non-etched bands are positioned to the right and left at both ends, the pertinent bands are reciprocally staggered so that, in geometric terms, they do not face opposite to the etched band of the other electrode foil, and winding or overlapping folding is conducted, resulting in the configuration of the element proper.

~~(3) A manufacturing method for electrolytic capacitor oriented toward large-capacity possessing a basic configuration as mentioned above, where non-etched bands are formed to the right and the left of the flattened capacitor element, approximately half of said bands are retained and the remainder cut away, and the remaining non-etched bands are inserted into narrow, slit-like grooves (edged) that are provided in advance in a pair of aluminum-made electrode leading plates used for both electrodes -- for example, curved arc-shaped aluminum plates -- and that run in the vertical direction when these are standing upright. Thus, the main unit is configured by providing a plurality of grooves constituting a set in the pair of electrode leading plates, inserting the plurality of non-etched bands pertaining to both ends of the flat element, and welding between the pertinent band and the groove edges.~~

3. Detailed description of the invention:

This invention pertains to a manufacturing method for electrolytic capacitor wherein band-like non-etched parts are left during the surface roughening treatment of high-purity aluminum foil, and these parts are utilized in the process following winding of the bipolar foil to

impart the first condition of aluminum welding for purposes of establishing non-induction, and further to develop a mechanism that seeks to rationalize and make the joining of electrodes more compact, and to foster improvement in the electrical properties and reliability of the product.

Conventionally, in the manufacture of large-capacity electrolytic capacitors, the foil for the anode or cathode is long in the winding direction. Consequently, the metal foil resistance part or inductance part of the metallic foil itself is prone to cause damage to capacitor properties, exposing it to an increase in loss values, weakness in high frequency properties and the like. The improvement of these points is therefore strongly desired. That is, the utilization of large-capacity capacitors at higher frequencies (10 KC-100 KC) has recently become an unavoidable necessity in, for example, computer power sources, both for purposes of reducing the size of the power source and reducing power consumption. Many improvements have been implemented in recent years relating to improvement of the study of the leader line position, increases in the number of leader lines, improvement in the quality of interposed paper, improvement of the impregnated electrolyte, and so on. On the other hand, relative to a structure typified by Japanese Patent Application S46-81740 which structurally follows comparable principles – that is, the conventional winding cylindrical structure – electrolytic capacitors have appeared that combine a structure that apparently has a different inclination and that bears a flat element block with a new electrode joining system.

However, in the former case, it is difficult to uniformly arrange and bundle the leader lines from the anode and cathode foil, and there is a profusion of anode and cathode leader lines. With the conventional method, there are many limitations and conspicuous inconveniences, and when one additionally considers the challenges to the characteristic limits of the pertinent

method, one can anticipate that the problems will ultimately remain. In contrast, with the method involving the block-bearing of a flat capacitor as in the latter case, it already contains in its structural principles' weaknesses in the efficient utilization of internal capacity. Moreover, it is necessary to have the highest level of welding technology and control technology in order to weld the laminated part of the etched foil and the aluminum sheets used for electrode leading, and there are also inherent difficulties in the manufacturing operations when viewed in general terms, that is, the highest level of impurity control and the like is required during the manufacturing ~~process as well~~ operations and so on.

In other words, in terms of the manufacturing method, there are concomitant weaknesses that tend to engender difficulties in the ordinary work environment – thermal stress is often imparted to the element itself in order to secure the welded parts, and element properties tend to deteriorate. Furthermore, in terms of the quality of the etched foil, it is difficult to maintain the continuous uniformity of the joined parts, and one may cite the usage efficiency of electrode foil and the utilization efficiency of internal capacity as problem points.

In contrast to these, the present invention described herein offers a manufacturing method for a large-capacity electrolytic capacitor with superior quality properties that provides the anode and cathode aluminum foil itself with non-etched bands that take account of welding for purposes of engendering non-induction in advance, that further employs a unique design with regard to the structure and arrangement of the aluminum sheets used for electrode leading, and adopts a configuration wherein thermal effects at the time of welding are minimized to the utmost, and the control of impurities in the welded parts can in principle be most safely conducted, and that also markedly improves the reliability and uniformity of the welded areas, and allows increases *in* capacity ~~usage~~ *utilization* efficiency.

The content of this invention is described below by giving a representative example.

Firstly, with regard to the continuous electrolytic etching of high-purity aluminum foil for anode and cathode, a conventional aqueous solution whose main component is hydrochloric acid may be used as the corrosive liquid, and there is nothing particular to note with regard to the electrolysis method. However, one of the characteristics of this invention definitely pertains to this etching process.

That is, in contrast to the conventional methods, with regard to the etching, a non-etched band of specified width (width 5 m/m or more) indicated by 1, ~~1 (a)~~ of Fig. 1 is left on part of the processed foil after it has passed through the etching process by adjusting the relation of the mutual positions of the original foil and the carbon electrodes in the solution and the interval between the foil and the carbon electrodes, or by artificially providing an electrical insulation strip in the vertical direction of the original aluminum foil.

That is, for example, in the continuous etching process, the interval between the carbon plate of the two electrodes arranged in parallel in the solution and the aluminum foil that moves its central face is set to approximately 2 cm, and the outside rear face and side face of the carbon plate are covered with a closely adhering hard film and are electrically cut off. While the aluminum foil is then dipped beforehand into the two carbon electrodes, the edge parts are made to protrude out by 1 cm or more from the plate of the two electrodes, and arranged so that they are hardly subjected to the influence of the electrolytic etching effect, after which continuous etching is conducted. This method is no more than one example of a very simple method for creating non-etched bands, but as the utilization of the etching foil of the central part can be

separately conducted, it is established as a fully practical method.

The two edge parts of the high-purity aluminum foil obtained in this manner consist of bands that may be regarded as like the practically non-etched band of 1 of Fig. 1 ~~or 1-(a)~~ of a specified width as in Fig. 1, and are obtained such that they border the etched band 2 of Fig. 1 ~~or 2-(b)~~.

As another method, in conjunction with the movement of the original aluminum foil, insulating films of specified width are continuously moved at the specified positions while closely adhering to the aluminum foil as if appended from both sides, and continuous etching is conducted, enabling the configuration of a plurality of non-etched bands such as 1 of Fig. 1 ~~or 1-(a)~~ (and others). Otherwise, methods such as one involving application of photosensitive resin are also conceivable.

Next, as the second step, after the etched foil is treated to make foil respectively designed *for* anode or cathode, when the anode foil and cathode foil are separated by the separating paper 3 of Fig. 2 *used* for impregnant retention, and mutually entrained ^, the non-etched band parts ~~1 and~~ 1(a) ^ of Fig. 2 that are present at the end part on one side of the cathode foil and anode foil are mutually staggered to the right and to the left, and winding is conducted. At this time, in principle, the etched bands ~~2~~ ^ and 2(b) of Fig. 2 face each other separated by the interposed paper, while the non-etched bands do not face each other, and the interposed paper is only sufficiently extensive to cover the etched bands, while the parts facing opposite to the non-etched bands are reduced as much as possible. If this is grasped in a cross-sectional manner, the overlapping state of the foil in the winding direction would ^ be like Fig. 2 ^. *Here, we state one or two examples of the specific capacitor manufacturing method pertaining to this mode.* ~~Thus~~,

as in Fig. 2 (A)
and 1(b)
2(a)
for example (A) (B)
That is,

after winding, the same non-etched band of the electrode foil ~~1 or~~ *or 1(b)* 1(a) ^ of Fig. 2 is positioned so as to directly face its own extended band. ^ *but, here, we discuss a configuration obtained by putting into block format an element that has been* flattened by light pressing, after winding this element in advance by flatly winding it in a folding format based on a sheet-like skeletal sheet, or winding it in a cylindrical shape with a hollow space inside. ~~In general, it is appropriate to have the winding frequency amount to approximately 10 times.~~

That is, ^the flat capacitor element obtained in this way has the non-etched bands ~~1 and~~ *or 1(b)* 1(a) ^ of Fig. 3(A) at both ends, and the bands are cut so that, for example, approximately half remains. With regard to the pertinent remaining band parts of Fig. 3(B)~~,9~~, the band parts only are pressed near the time of the cutting, and one undertakes to compress the handles of the end areas to the utmost. An abbreviated drawing of this is shown in Fig. 3(A) (B). The position of the remaining band parts ~~9~~ ^ does not particularly have to be in the central area, and these are set in advance so that they conveniently fit into the position of the slit-shaped groove of the below-mentioned leading electrode aluminum plate.

That is, as shown, for example, in Fig. 4, the pair of residual projecting parts *9* ^ of the non-etched bands of the flat capacitor face opposite to the curved, arc-shaped aluminum plates of Fig. 4(A) (used for electrode leading) that are directly coupled to the terminal parts ~~A, B~~, and ~~search~~ *insert* ^ in a sliding manner into the slit-like, edged grooves 4 (used for insertion of the non-etched bands) having a width of approximately 2-3 m/m that are provided on the pair of independent plates. *Moreover,* ^ it is also the same with ~~curved~~ flat aluminum plates (Fig. 4(B)) and the like. 7 indicates the plate leading part that connects as is to the terminal. The overall circumstances are as shown in Fig. 5. The pertinent slit-like, edged grooves 4 are usually

set in a plurality, and the principle is to design and set them in advance so that interior space is reduced to the minimum by ~~search~~ *insertion of* ^ of a plurality ^ flat capacitors ~~8~~.

In this way, for example, the space encompassed by the aforementioned pair of arc-shaped aluminum plates 6 used for electrode leading that face opposite each other is completely filled by the elements as the non-etched band parts of the plurality of flat capacitors ^ are ~~searched~~ *inserted* ^ into the grooves. In this case, it is desirable that there be two or three types of size of the flat elements. Next, the non-etched band projections that are ~~searched~~ *inserted* ^ into the edged grooves are further compressed and aligned by both edges, and are sharply cut along the ends for purposes of further leveling. In this way, their ends not only embody a sectional structure that is very effective for aluminum welding, but also reduce the effects exerted on the internal element itself by overheating during welding, and also provide good ~~conditions~~ *settings* ^ from the standpoint of the control of impurities. Thus, aluminum welding can be easily and safely conducted as in Fig. 6 by the MIG welding method or the like.

With regard to the elements obtained in this way, one may consider measures such as covering part of the electrode leading plate of the anode with insulating film or the like near the time of paste impregnation, after which they are made into a finished product as an electrolytic capacitor mainly via the conventional procedures. In any case, with the aforementioned configuration, the ~~former~~ *of this invention* product ^ greatly reduces the resistance and inductance possessed by electrode foil, clearly imparts a high degree of reliability to the aluminum welded surface, and

further minimizes the inclusion of impurities by the simplification of the work, with the result that it clearly secures the superiority of general electrical properties, frequency properties and high-ripple properties.

That is, this invention is a manufacturing method for electrolytic capacitor oriented toward large-capacity capacitors that enables improvement of high-frequency properties and high-ripple properties in particular, as well as reliability.

4. Brief description of the drawings:

Fig. 1 shows a representative example of surface partitioning of the aluminum foil provided with non-etched bands of this invention.

(A)

Fig. 2 ^ shows a representative example viewed from a cross-section showing the inter-related positions of the electrode foil and the interposed paper during element winding in accordance with this invention. *Fig. 2(B) is a most simple structural example of a capacitor element according to this invention.*

Fig. 3 (A) is an abbreviated outside drawing of the flattened ~~capacitor element according~~ *as a specific example of the capacitor element according to this invention,* ~~to this invention~~ ^ [sic], and transparently >*shows* by means of a broken line the border of the respective non-etched and etched bands of the bipolar foil. (B) is a schematic diagram of the present invention after parts of the non-etched bands have been cut away, and the parts [sic] have been compressed.

(A) (B) *two*

Fig. 4 ^ show ~~one~~ ^ examples of electrode leading aluminum plates according to this invention.

as a specific example of the capacitor

Fig. 5 is an outside drawing of the element proper ^ according to this invention.

Fig. 6 shows an abbreviated outside view of the aluminum welded places after inserting

band provided in the electrode leading plates pertaining to an example of the remaining non-etched ^ parts into the slit-like grooves ^ ~~in accordance with~~ this invention and conducting edge treatment.

1 is the non-etched band part, 2 is the *etched band,*
1(a) *2(a)*
~~1~~ ^ is the non-etched band part of the cathode foil, ~~2~~ ^ is the etched band of the cathode foil, 1~~(a)~~ ^ is the non-etched band part of the anode foil, 2(b) is the etched band of the anode foil, 3 is the separating paper for impregnant retention, 4 is the slit-like edged groove, 5 is the end area of the edged part, 6 is the arc-shaped electrode leading aluminum plate, 7 is the plate lead ~~plate~~ part that connects as is to the terminal, 8 is the flat capacitor. *9 is the remaining projection of the non-etched band.*

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Fig. 1

[see source for figure]

Fig. 2(A)

2(b)
↓
[see source for figure]
↑ ↑ ↑
1(a) 2(a) 1(b)

Fig. 2(B)

[see source for figure]
↑ ↑
1(a) 1(b)

Fig. 3(A)

[see source for figure]

Fig. 3(B)

[see source for figure]

Fig. 4(A) [see source for figure]

Fig. 4(B) [see source for figure]

Fig. 5 [see source for figure]

Fig. 6 [see source for figure]

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